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series cannot be the same when  $n \neq m$ , there is some rational number between them.

Let  $\sqrt[n]{n} = e + f$ , where  $f$  is the decimal part, and  $\sqrt[m]{m} = g + h$ , where  $h$  is the decimal part. Then  $r = e + k$ , where  $k$  is any number from 1 to  $g - e - 1$ .

171. Proposed by W. J. GREENSTREET, M. A., Editor of The Mathematical Gazette, Stroud, England.

$$\text{If } \lim_{x \rightarrow a} \frac{\phi(x)}{\psi(x)} = \lambda, \text{ show } \lim_{x \rightarrow a} \left[ \frac{\lambda}{\phi(x)} - \frac{1}{\psi(x)} \right] = \frac{\lambda \psi''(a) - \phi''(a)}{2\phi'(a)\psi'(a)}.$$

Solution by G. W. GREENWOOD, M. A., Dunbar, Pa.

By hypothesis,  $\phi(a) = 0$ , and  $\psi(a) = 0$ . We must assume that  $\phi'(a) \neq 0$  and  $\psi'(a) \neq 0$ . Then

$$\lim_{x \rightarrow a} \frac{\phi(x)}{\psi(x)} = \left[ \frac{\phi'(x)}{\psi'(x)} \right]_{x=a} = \lambda. \quad \therefore \lambda \psi'(a) - \phi'(a) = 0.$$

$$\begin{aligned} \lim_{x \rightarrow a} \left[ \frac{\lambda}{\phi(x)} - \frac{1}{\psi(x)} \right] &= \lim_{x \rightarrow a} \left[ \frac{\lambda \psi(x) - \phi(x)}{\phi(x)\psi(x)} \right] = \lim_{x \rightarrow a} \left[ \frac{\lambda \psi'(x) - \phi'(x)}{\phi(x)\psi'(x) + \phi'(x)\psi(x)} \right] \\ &= \lim_{x \rightarrow a} \left[ \frac{\lambda \psi''(x) - \phi''(x)}{\phi(x)\psi''(x) + 2\phi'(x)\psi'(x) + \phi''(x)\psi(x)} \right] = \frac{\lambda \psi''(a) - \phi''(a)}{2\phi'(a)\psi'(a)}. \end{aligned}$$

Also solved similarly by G. B. M. Zerr. Unless one assumes that  $\phi(a) = \psi(a) = 0$ , the problem is not true, as may be easily verified. ED. F.

## PROBLEMS FOR SOLUTION.

### ALGEBRA.

297. Proposed by W. J. GREENSTREET, Marling School, Stroud, England.

If  $a, b, c, d, f, g, h$  are all real, and  $a, ab - h^2, abc + 2fgh - af^2 - bg^2 - ch^2$  are all positive, show that  $b, c, bc - f^2$ , and  $ca - g^2$  are also positive.

### GEOMETRY.

330. Proposed by J. J. QUINN, Ph. D., New Castle, Pa.

A line pivoted at the origin revolving with a constant angular velocity, intersects another moving parallel to the  $Y$ -axis with a constant linear velocity. (1) Find the locus of their intersection when the ratio of their velocities is as  $m:n$  referred to a quadrant and a radius, respectively. (2) Assume  $m=3$  and  $n=2$ , and apply to the trisection of an angle. (3) Under what conditions will this curve become a quadratrix? (4) Name the curve.